

PTO 09-2228

CC=JP  
DATE=19930709  
KIND=A  
PN=05171164

METHOD OF HUMIDIFYING NATURAL GAS  
[TEN-NEN GAS NO KASHITSU HOHO]

KOICHI OKADA, ET AL.

UNITED STATES PATENT AND TRADEMARK OFFICE  
WASHINGTON, D.C. JANUARY 2009  
TRANSLATED BY: SCHREIBER TRANSLATION, INC.

PUBLICATION COUNTRY	(10):	JP
DOCUMENT NUMBER	(11):	05171164
DOCUMENT KIND	(12):	A
PUBLICATION DATE	(43):	19930709
APPLICATION NUMBER	(21):	3-101980
APPLICATION DATE	(22):	19910405
INTERNATIONAL CLASSIFICATION	(51):	C10L 3/00
PRIORITY COUNTRY	(33):	N/A
PRIORITY NUMBER	(31):	N/A
PRIORITY DATE	(32):	N/A
INVENTOR(S)	(72):	KOICHI OKADA; AND YOSHIO NAKAMURA
APPLICANT(S)	(71):	COSMO ENGINEERING CO., LTD.
DESIGNATED CONTRACTING STATES	(81):	N/A
TITLE	(54):	METHOD OF HUMIDIFYING NATURAL GAS
FOREIGN TITLE	[54A]:	TEN-NEN GAS NO KASHITSU HOHO

[Claims]

1. A method of humidifying natural gas in a town gas supply process using natural gas, said method being characterized by comprising the steps of:

guiding a part of raw material natural gas to a humidifying tower;

saturating the gas with water in the humidifying tower; and

mixing with the humidified gas the remaining raw material natural gas that bypassed the humidifying tower,

wherein the dew point after the mixing is measured and thereby the ratio of mixing is controlled.

[Detailed Description of the Invention]

[0001]

[Applicable Industrial Field]

The present invention relates to a method of humidifying natural gas in a town gas supply process.

[0002]

[Prior Art]

Town gas is gas used in general households, and various types of gases have been used in the town gas. In the early days of town gas industries, coal gas was mainly used. With current increase of population of gas companies,

petroleum gas, natural gas, butane air, etc., have been used in view of the geographical reason and resources.

[0003]

However, because of certainty of ensuring raw materials, stable cost, reduction of production cost, a type of gas used in a large company has been gradually shifting to natural gas. Needless to say, even in medium to small sized companies, use of natural gas may be preferred, but under the current circumstance, they cannot use natural gas because of the cost for equipment, etc. In medium to small sized companies adjacently located to a big company or a company using natural gas, it may be possible to receive supply of natural gas from the company and then supply to households which use natural gas.

[0004]

Since it is not necessary to have an expensive tank for freeze-storing natural gas or receiving equipment in this method, the method can be easily implemented. Needless to say, it should be understood that it is necessary to change the gas appliances. Since this change may be necessary in any case when the type of gas to supply is significantly changed regardless of the method, such change cannot be considered as a drawback.

[0005]

[Problems to be Solved by the Invention]

However, the method has the following problems. In medium to small sized companies, which sell gas from a long time ago, they still have very old gas pipes in city. These pipes are made from cast metal because of problems of corrosion, etc., and therefore cannot be welded or threaded. For this reason, those pipes are connected by so-called "a socket and spigot joint". The joint has a receiving opening on one end, and joints to another pipe inserting the other end. In order to achieve air-tightness, packing hemp rope in the space and tightly putting therearound, lead is casted in or cement is poured in so as to join.

[0006]

In this method, it is important to keep the air tightness that the hemp rope contains water, and if the rope is dried, the rope loses its sealing property. In case of conventional town gas, since water-washing is performed prior to supply and the gas contains considerable amount of water (the saturation amount at the temperature if it is a large amount), the water content of the rope is maintained at suitable degree without being dried out.

[0007]

However, in case of natural gas, natural gas is dry gas that has substantially no water content. Therefore, if

natural gas passes the gas pipe, the hemp rope will be completely dried, and the sealing is lost and thereby the gas may be leaked. In addition, substances adhered inside the pipe may come off by dryness and reach a governor or gas appliances with the gas and may cause breakdown of the device or the appliances.

[0008]

Therefore, in this field, when the conventional water containing gas is switched to natural gas, while any of the socket and spigot joints will be disused in the long run, gas pipes in busy urban area of city may not be immediately exchanged. For this reason, a method has been in demand, which is safe even if conventional gas pipes are used for a short amount of period.

[Means to Solve the Invention]

In view of the above, the present inventors diligently conducted thorough studies and completed the invention. The invention is characterized by comprising in a town gas supply process using natural gas the steps of: guiding a part of raw material natural gas to a humidifying tower; saturating the gas with water in the humidifying tower; and mixing the remaining raw material natural gas that bypassed the humidifying tower with the humidified gas. The invention is characterized by measuring the dew point after

the mixing and controlling the mixing ratio by the measured dew point.

[0009]

The term "natural gas" as used herein means gas essentially containing methane.

[0010]

The term "humidifying tower" means a device to impart moisture to the gas, and may have any shape or structure. As the humidifying tower, the one like a scrubber, which sprays water from the upper side to the gas flowing from the lower side, may be preferably used. However, a type, which simply blows the gas in water, may be also used. Since adjustment of the water absorption rate in this step is difficult, water is excessively supplied so as to substantially saturate the gas with water. The amount of water absorption is adjusted by mixing with dry gas from a bypass line. This is one aspect of the invention, and thereby the device of the invention may be inexpensive.

[0011]

The term "bypass" means to enable mixing gas with discharged gas from the humidifying tower without passing the humidifying tower. Providing a flow adjusting valve on the bypass line, the ratio of flows in the humidifying tower and the bypass line is controlled. This ratio may be

determined according to the dew point of the mixed gas. In other words, if the dew point of the mixed gas is lower than a specified dew point, the degree of openness of the bypass valve is reduced, and in the opposite case, the degree of the openness may be increased.

[0012]

A way of determining the dew point may vary depending on the temperature at the time, the degree of the socket and spigot joints, etc. Of course, the dew point does not have to be controlled at one point, and may be controlled at any number of points as long as it is within specified range. In this case, the upper limit is an issue of condensation of water in the gas. More specifically, if the water content in the gas becomes condensed, there may be a problem of corrosion or freezing, so that the upper limit has to be a temperature lower than the dew point. Therefore, it is normally set to a few degrees lower than the air temperature at the time.

[0013]

Furthermore, the lower limit may be determined in view of a temperature where the hemp rope in the socket and spigot joint loses its sealing property or where substances adhered in the gas pipe come off. Accordingly, the dew point has to be higher than a certain temperature.



As a result, the device is operated at temperatures between the upper limit determined by the above-described dew point and the lower limit that is determined by the sealing property, etc. However, in the short run, there is no problem even if it exceeds any of the limits. This is because even if it exceeds the dew point, the pressure becomes decreased as it close to household at the end, and even if it exceeds the lower limit, there will be no problem in the sealing property in the short run.

[0014]

For an example of the lower limit and the upper limit, it is about 5 to 15°C during summer time and about 2 to 5°C during winter time. Needless to say, since the air temperature is different in Hokkaido or Kyushu, the range may be changed according to the area. If the range is indicated in moisture content, it is about 2.5 to 3.5 g/Nm<sup>3</sup>. As described above, this may vary depending on the air temperature, supply pressure, etc., and this invention will not be limited by the water content.

[0015]

[Example]

Hereunder, referring to examples, a method of the invention will be fully described. Fig. 1 is a schematic

flowchart showing an example of a device [1] to carry out the method of the invention. First, raw material natural gas is separated into a humidifying line [2] and a bypass line [3], and the humidifying line has a humidifying tower [4] and the bypass line [3] has a bypass valve [5]. A mixer (which may be connected by piping) is provided on the outlet side of the humidifying tower [4], and thereby humidified gas and dry gas are mixed. A dew point meter [7] is provided on the downstream side of the mixer [6], and works with a valve driving device. In addition, a layer of filling material [8] to increase contact area between water and gas is provided in the humidifying tower [4]. Water is jetted from a spray nozzle [9], pooled in the bottom part of the humidifying tower, and is circulated by a pump [10]. Furthermore, in order to supplement water content entrained in gas, an inlet [11] for clean water is provided. A supply valve [12] is provided at the inlet for clean water, and is controlled by values of a level gauge for water pooled therein.

[0016]

First, raw material natural gas is separated into the humidifying line [2] and the bypass line [3], then saturated with water in the humidifying tower, and sent to the mixer [6]. In the mixer, the humidified gas is mixed

with dry gas and the dew point is measured with the dew point meter. If the dew point is higher than a specified temperature, the degree of openness of the bypass valve is increased.

[Effects of the Invention]

According to a method of the invention, suitable water content can be easily imparted to completely dry natural gas while controlling the dew point. Accordingly, breakage of sealing at the socket and spigot joints can be prevented and coming off of dust, etc. may be also prevented. Therefore, leakage of gas and breakage of a governor and a gas appliance can be significantly reduced. The amount of water to add can be extremely easily controlled, and it is not necessary to control the amount of water to add to the gas.

[Brief Description of the Drawings]

Fig. 1 is a schematic flowchart indicating one example of a device to implement a method of the invention.

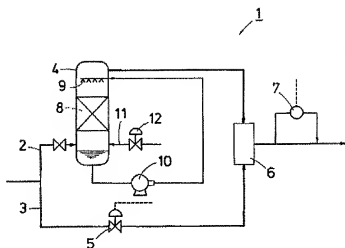
[Description of Reference Numerals]

- 1: Natural gas humidifying device
- 2: Humidifying line
- 3: Bypass line
- 4: Humidifying tower
- 5: Bypass valve

- ```

6:  Mixer
7:  Dew point meter
8:  Filling material
9:  Spray nozzle
10: Pump
11: Clean water
12: Inlet valve for clean water

```



[Fig. 1]